Development of a Bayesian Cloud Mask for All GOES-R Applications

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Many applications of geostationary satellite data require identification of cloudy radiances prior to the application of algorithms to retrieve geophysical quantities. It is essential for the GOES-R project to have an accurate and well characterized cloud mask. A cloud mask already exists for the Advanced Baseline Imager (ABI) and is a required input for many GOES-R products but has known problems and limitations. For example, the GOES-R sea surface temperature (SST) Algorithm Working Group (AWG) has already had to add in extra quality tests to their algorithm to remove unidentified cloudy (and therefore cold) pixels which made it through the current GOES-R cloud mask. We are in the process of developing and testing an alternative cloud detection methodology for GOES-R which is based on forward modeling and Bayes' Theorem. This improved version (exploiting GOES-R capabilities) is similar to the Bayesian algorithm running on the operational GOES sea surface temperature processing system at NOAA/NESDIS. The Bayesian method should: 1) improve on the current GOES- R cloud mask and mitigate the current risk posed by reliance on a single cloud detection algorithm; 2) provide the GOES-R user community with some level of continuity from previous geostationary SST products; and 3) allow tailoring of the cloud detection to the requirements of the individual applications. For GOES-R, the Bayesian method is extended beyond the current GOES-SST algorithm to take advantage of additional channels offered by the ABI. These additional channels plus recent developments in forward modeling enable the extension of the method to cloud detection over land, meaning this project offers significant risk reduction for a wide range of GOES-R applications. During this project, the extended Bayesian method is being evaluated by applying it to proxy data (primarily Meteosat-SEVIRI) and comparing the results with respect to derived products such as sea surface temperature and land surface temperature, as well as direct observations of clouds from the CALIPSO lidar.